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the respiration of muscle is carried on more energetically in muscles which are made to contract than in muscles which are allowed to rest. Prof. Matteucci, who has recently ratified this fact by some very elaborate investigations, holds that the chemical actions of muscular respiration are transformed into electricity, and the electrical into contractile force; but there is just as good reason for supposing that the increased chemical action may be required to keep up the muscular current, which current is being continually annihilated by the actions which bring about contraction. And thus, after all, the increased respiration of muscles which are made to contract, may refer, not to the contraction, but to the renewal of the state of relaxation. At any rate, it is scarcely possible to refer to this fact as an objection to the view which is set forth in this paper.

“Regarded in an electrical point of view then, there appears to be good reason for concluding that the history of muscular action is in harmony with the theory which I have endeavoured to set forth at various times, and more recently in the second edition of a work having for its title, ‘Epilepsy and other Convulsive Affections, their Pathology and Treatment :’—a theory, according to which, in every case, pathological as well as physiological, muscular contraction is produced, *not* by the stimulation of any vital property of contractility belonging to muscle, but by the simple cessation of the action of certain agents—electricity, nervous influence, and others, which had previously kept the muscle in a state of relaxation or expansion.”

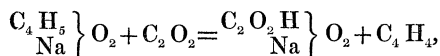
The following communications were also read :—

- I. “On the Action of Carbonic Oxide on Sodium-alcohol.” By J. A. WANKLYN, Esq. Communicated by Professor E. FRANKLAND. Received February 15, 1859.

Dr. Geuther* found that sodium-alcohol $\left(\begin{smallmatrix} C_4 H_5 \\ Na \end{smallmatrix} \right) O_2$ when gently warmed in a stream of carbonic oxide, yielded not pre-

* Annalen der Chem. und Pharm. Jan. 1859.

pionate of soda, but formiate of soda, with evolution of olefiant gas. The reaction, accordingly, might be represented thus:—



and would consist in the replacement of $\text{C}_4 \text{H}_6$ by $\text{C}_2 \text{O}_2$.

On inspection of Dr. Geuther's paper it appeared that the above reaction was not established with sufficient certainty. The presence of $\text{C}_4 \text{H}_4$ as a gaseous product was not satisfactorily proved by direct experiment, but inferred from the production of formiate of soda.

Berthelot has shown that carbonic oxide is capable of uniting with the hydrated alkalis, so as to form alkaline formiates. Also, it is extremely difficult, and perhaps impossible, to obtain sodium-alcohol free from hydrate of soda. It seemed, therefore, not unreasonable to suspect that Dr. Geuther's formiate came from hydrate of soda accompanying the sodium-alcohol employed in his experiments. The investigation about to be described shows that such was really the case.

Sodium-alcohol, freshly prepared from sodium and anhydrous alcohol, was introduced into small glass bulbs, and hermetically sealed therein. One of the bulbs, containing '406 gramme of crystallized sodium-alcohol, was placed in a flask of 155 cubic centimetres' capacity. The neck of the flask was contracted before the blowpipe. Carbonic oxide, after slow passage through potash solution, and then through sulphuric acid, was next made to fill the flask by displacement. Finally, the contracted neck of the flask was closed by fusion, and thus the bulb containing sodium-alcohol was inclosed in an atmosphere of pure oxide of carbon. By agitation the inclosed bulb was broken, and its contents came freely in contact with the carbonic oxide contained in the flask. Particular attention was paid during this stage of the process, and the fused sodium-alcohol was seen flowing over the inner surface of the flask.

After a digestion in the water-bath lasting for more than four hours, the flask was opened under mercury, when a slight contraction was observed in the volume of its gaseous contents. This contraction, amounting to about one-fifth of the entire contents, was due no doubt partly to absorption of carbonic oxide by traces of hydrate of soda, and partly to the difference between the temperature at the

time of sealing before the blowpipe, and that at the time of opening under mercury.

The following are the particulars of an examination of the gas contained in the flask after the four hours' digestion at 100°C .

In order to remove any alcohol vapour, the gas was agitated with about one-fifth of its volume of boiled distilled water, when it underwent very little diminution in volume—a circumstance, which shows that no volatile liquid capable of absorption by water had been generated during the reaction.

Some of the washed gas was then treated with a potash bullet and with pyrogallie acid, in order to remove any traces of carbonic acid and oxygen. The amount of these gases present was very trifling, as the readings show :—

Volume of gas taken (corrected (dry) at 0°C . and 1000 millims'. pressure)	65.091
Volume of gas after potash and pyrogallie acid (corrected (dry) at 0°C . and 1000 millims'. pressure)	64.734

After this treatment a portion of the gas was transferred to the eudiometer, in which it furnished the following readings :—

	Volumes.	Tem- perature. Cent.	Pressure.	Corrected volumes dry at 0°C and 1000 millims'. pressure.
			millims.	
Gas taken (moist)	148.0	4.9	202.9	29.500
After the addition of air (moist)	306.5	5.3	352.8	106.077
After explosion (moist)	282.1	5.7	330.6	91.357
After potash (dry)	222.1	5.4	290.0	63.161
After the addition of hydrogen (dry)	294.0	5.7	357.1	102.884
After explosion (dry)	286.4	5.9	350.1	98.150

From which is deduced :—

Gas taken	29.500	
Nitrogen	1.072	
		In per-centage.
Gas free from nitrogen	28.428	100.00
Carbonic acid	28.196	99.18
Contraction	14.720	51.78
Oxygen consumed	14.488	50.96

The theoretical numbers for carbonic oxide and for olefiant gas are as follows :—

	Carbonic oxide.	Olefiant gas.
Volume taken	100	100
Carbonic acid	100	200
Contraction	50	200
Oxygen consumed	50	300

Comparison of the analysis with these numbers will show that the gas was pure oxide of carbon. Furthermore, if we assume that the trifling departure from the theoretical quantities for pure oxide of carbon was due to the presence of olefiant gas, and if we calculate how much olefiant gas would be required, we obtain a negative value for the quantity of olefiant gas from one equation, and a positive one from the other equation, viz. :—

By employing for data the original volume and the carbonic acid generated, the value of C_4H_4 is negative.

Vol. of C_4H_4 = vol. of CO_2 — original vol. = —0·82 per cent.

By employing for data the original volume and the contraction, the value of C_4H_4 becomes positive.

Vol. of C_4H_4 = $\frac{2}{3}$ contraction — $\frac{1}{3}$ original vol. = 1·19 per cent.

This want of conformity shows that C_4H_4 will not satisfy the conditions of the case, and may be regarded as excluding the supposition that a trace even of C_4H_4 was present in the gas examined.

When it is considered that on Dr. Geuther's hypothesis every volume of carbonic acid absorbed should be replaced by an equal volume of olefiant gas, and when it is borne in mind that sodium-alcohol and carbonic oxide must have been less perfectly exposed to mutual action in Dr. Geuther's experiment than in the one just described, I think the conclusion cannot be avoided, that that experimenter's formic acid came not from sodium-alcohol, but from hydrate of soda.

In a previous experiment I failed to obtain propionic acid on exposing at $100^\circ C.$ carbonic oxide along with sodium-alcohol, and in so far my result agrees with that of Dr. Geuther.

To resume : at $100^\circ C.$ sodium-alcohol is without action on carbonic oxide.

This research was made in the laboratory of Prof. Bunsen.